

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.



FOOD CONSUMPTION OF CHILDREN AT THE NATIONAL CHILD RESEARCH CENTER

HELEN NEBEKER HANN, formerly *assistant home economics specialist*, and
HAZEL K. STIEBELING, *senior food economist, Economics Division*,
*Bureau of Home Economics*¹

CONTENTS

	Page		Page
Purpose and plan of study.....	1	Distribution of calories among specified classes	
The children studied.....	2	of food.....	20
Type of food served at the school.....	2	Cost of food served at the nursery school.....	22
Quantity of various foods eaten.....	5	Summary and conclusions.....	24
Energy value of the food consumed by in- dividual children at home and at school.....	9	Literature cited.....	25
Nutritive value of meals served at the nursery school.....	15	Appendix.....	27

PURPOSE AND PLAN OF STUDY

In order to obtain data on the food-consumption habits and the nutritive value of diets of healthy young children, quantitative studies of the food consumed by children enrolled at the National Child Research Center, Washington, D. C., were made during the period 1931-36. This report describes the types of meals served to children ranging in age from 24 to 71 months. It includes data on the food intake of these children expressed in terms of quantities of common foods, and in terms of essential nutrients.

The studies were based on observations made both at school and at home. The school observations included both individual children and groups classified according to age; the home observations were confined to individual children. A total of 57 group studies were made as follows: 24 on children from 24 to 41 months of age, 29 on children from 42 to 53 months, and 4 on children from 54 to 71 months. A total of 154 individual studies were made at school in addition to 57 studies of individual children both at home and at school. All studies were for periods of 3 to 5 days each, and the records covered the following points:

The quantities, by weight, of various foods and prepared dishes eaten per school meal by individual children. These data were collected from 1931 to 1936, inclusive.

The energy value of all food eaten at home and at school by individual children. These studies were emphasized during the years 1931 to 1933.

The quantities of each food and the nutritive value of meals eaten at school by individual children and by groups of children. These records were kept from 1931 to 1936.

Expenditures for specified types of food. Figures are available from 1931 to 1937.

The growth of the children in height and weight. These measurements were taken every 2 weeks, through the whole period studied.

¹ The authors acknowledge gratefully the assistance of Rosa Lee Reed Kime and Elsa Moody, nutritionists at the National Child Research Center, Washington, D. C., in collecting the data, and the help of Esther Batchelder, formerly home economics specialist, Bureau of Home Economics, in the preparation of the manuscript.

THE CHILDREN STUDIED

Normal, healthy children ranging in age from 18 months to 6 years attend this school from 8:30 a. m. until 4 p. m. Mondays through Fridays. When the center was established in 1928 to stimulate and coordinate research in the field of child development, it was hoped that the children in attendance would represent a random sample of the population. The parents who enroll their children are, however, above average in socioeconomic status.

All of the children included in these studies were considered normal by the physician who gave them careful examinations twice yearly and inspected them every morning upon arrival. Only well children were allowed to remain in school. Every 2 weeks they were weighed and measured by the nutritionist who observed them for any changes in their general condition.

In height and weight most of the children were above average as judged by Woodbury's standards (27).² Of 44 children, enrolled in a fall session, who remained 8 consecutive months or longer during the period covered by these studies, 16 were found to be tall, both at the beginning and at the end of their first complete school year; 28 were medium in height, and none were short according to Woodbury's standards. During the year no child shifted from one category to the other. In the fall, 25 of these 44 children were within 5 percent of average weight for height, 13 were more than 5 percent above, and 6 were more than 5 percent below average weight for height. In the spring, 24 of the 44 were within 5 percent of average weight for height; 17 were more than 5 percent above, and only 3 were more than 5 percent below average weight for height.

A few children have attended the school who, although well and active, were below average weight for height and build according to accepted standards and according to the judgment of the examining physician. This condition could not be traced to any physical defect. The children were "small eaters" and did not respond to efforts to increase their appetites either by changing the methods of feeding or the type of food they were given. They maintained apparent good health.

Shortly after the enrollment of a child, the parents were asked to keep a record of the child's food intake at home for a period of 2 weeks. If the child's home diet appeared to be unsatisfactory from any point of view, the nutritionist conferred with the mother and helped insofar as possible to effect an improvement.

TYPE OF FOOD SERVED AT THE SCHOOL

The school furnished a noon meal which was the children's main meal of the day, and an afternoon lunch which consisted of a glass of milk and a graham cracker. When these studies were begun no morning feeding was given at school. After 1934, however, one-fourth cup of tomato juice was given each child shortly after his arrival. The noon meal provided egg, meat, or other protein-rich main dish, a vegetable rich in vitamins or minerals, potato or another starchy food, whole-wheat toast or sandwich, milk, and a dessert of high nutritive value. The food served at school was planned to supply about half the child's daily food requirements.

² Italic numbers in parentheses refer to Literature Cited, p. 25.

The following menus are typical of the combinations served at the noon meal since October 24, 1932:

Monday

Ground beef with brown
rice and tomato.
Buttered spinach.
Toast.
Baked custard.
Milk.

Hard-cooked eggs with tomato sauce.
Mashed potatoes.
Buttered string beans.
Toast.
Stewed prunes.
Milk.

Tuesday

Creamed hard-cooked eggs.
Mashed potatoes.
Buttered carrots.
Chopped lettuce sandwich.
Bananas with raisin sauce.
Milk.

Liver loaf.
Creamed mixed vegetables.
Chopped spinach sandwich.
Apricot tapioca cream.
Milk.

Wednesday

Beef stew with vegetables.
Toast.
Apricot whip with custard
sauce.
Milk.

Goldenrod eggs.
Buttered peas.
Toast.
Date cornstarch pudding.
Milk.

Thursday

Baked liver, tomato, and
spaghetti.
Buttered peas.
Chopped carrot sandwich.
Prune betty.
Milk.

Broiled ground beef.
Scalloped potatoes.
Buttered cabbage.
Toast.
Crushed pineapple with custard sauce.
Milk.

Friday

Scrambled eggs.
Scalloped potatoes.
Buttered string beans.
Toast.
Peach tapioca.
Milk.

Creamed haddock.
Buttered carrots.
Chopped cabbage sandwich.
Whole-wheat bread pudding.
Milk.

In preparing the food, attention is given to texture and to the form in which the food is served so that the children will be able to feed themselves and develop good habits of mastication. Vegetables, meat, and fruits are cut in small pieces or slices. Dishes such as puddings, mashed potatoes, or squash are made a pleasing consistency, not too thick, too thin, or too dry. Foods that require chewing are served frequently.

Food of high quality but not the most expensive varieties and forms on the market are selected personally by the nutritionist in charge. In preparing it for the table, care is taken to conserve natural delicate flavors and nutritive values. The recipes used in the preparation of food have been standardized to furnish a uniform product. Ingredients are weighed; the size and shape of utensil for cooking any given dish are held uniform; the length of the cooking time required to produce a good product is kept as constant as possible under conditions imposed by the available equipment. When seasoning is required, care is taken to produce a palatable but not a highly seasoned product.

The present practices at the center with regard to menu making for noon meals were developed in part as a result of the studies to be described. The following summary may be useful to those responsible for feeding children of this age at school. For convenience, foods of similar nutritive value are discussed together.

MILK AND MILK PRODUCTS

Considerable milk is used in cooking, although most of the milk is served as a beverage. The total volume of milk readily accepted by a child seems to be related to the size of the glass in which it is served. During these studies the total intake was found to be greater, for example, when 7-ounce glasses were used than when either 3½- or 4-ounce cups were used. Reinforcing whole fluid milk with skim-milk powder was found to be an effective method of increasing the consumption of milk solids other than fat, without increasing the volume. This reinforced milk was readily accepted for drinking and in food preparation.

VEGETABLES

A green, leafy vegetable or some other kind high in iron is served almost every day. Less familiar vegetables are served occasionally, so that the children gradually may become accustomed to different kinds. Vegetables are served buttered more often than creamed. Potatoes are served two or three times a week.

FRUIT AND OTHER DESSERTS

Desserts are usually fruit or a combination of fruit with custard, with cornstarch pudding, or fruit scalloped with buttered bread crumbs. Cornstarch pudding delicately flavored with cocoa, a favorite dessert, is served about once a month or less. Baked custard is well liked, and also bread pudding made with whole-wheat bread. Both prunes and apricots, inexpensive, flavorful, and high in food value, are usually served in some form each week. Sliced fresh fruits such as peaches or pears are served when in season.

EGGS, MEAT, AND OTHER HIGH-PROTEIN FOODS

Eggs are served three or more times a week either as the main dish or in the dessert. Liver is served in some form once a week, and some other kind of meat usually once during the week. On other days there may be fish, bean puree, or bacon. Meat is ground or chopped fine, and coarse fibers, skin, and large blood vessels are removed. Meats are stewed, baked, or broiled, but are never fried.

GRAIN PRODUCTS

The grain products used are chiefly whole-wheat bread and brown rice. Toast is lightly buttered. Sandwiches are filled with raw fruit or vegetables chopped fine and mixed with a small amount of butter. Bread slices for toast and sandwiches are cut in quarters. Each child usually eats the equivalent of one-half slice of bread as toast, or of one-half to one slice of bread (cut thinner) as a sandwich. Usually, toast is served three times a week, and sandwiches twice.

FATS AND SUGARS

Butter and bacon are the only fat foods appearing in the diet. Butter is used rather sparingly for vegetables, sandwiches, and toast. From one-fourth to one-half teaspoon is used for a whole slice of bread or toast. The quantity of butter used with vegetables is not large, about one-fourth pound to a quantity of vegetables serving 45 persons, including children and adults.

Usually brown sugar is used for the mild sweetening of desserts. Molasses, because of its iron content, might well have been used. However, at the center it seemed to be a food that needed to be introduced into the diet gradually. It was not readily accepted by the children the few times it was served.

QUANTITY OF VARIOUS FOODS EATEN

At irregular intervals between April 1931 and April 1936 the weights of the different foods actually eaten per school meal were recorded for individual children and for groups of children. The nutritionist served the food and adjusted the size of the servings to the children's probable need and appetite. The children were expected to eat all the food served to them and were served again if they wished. Their eating periods were supervised by trained nursery-school teachers. One teacher and three or four children were served at one small table.

Customarily, children under $3\frac{1}{2}$ years of age were given their noon meals in one room, those from $3\frac{1}{2}$ to $4\frac{1}{2}$ years in another, and those from $4\frac{1}{2}$ to 6 years in a third. One hundred and fifty-four studies covering 3 to 5 days each, were made of the food intake at noon meals by individual children. In addition, 24 studies were made of the food eaten at school during 3- to 5-day periods by groups of the youngest children. Twenty-nine studies of group food consumption were made of the second age class, and four studies of the oldest group. Daily attendance in the groups varied from 8 to 20, with an average of about 14 children.

The quantities of a number of different kinds of food eaten per meal by children in the three age groups are shown in table 1. While in the course of a few years considerable variation might be encountered in the quantity eaten by normal children of any one prepared dish (see column showing the range of weights) the averages and median figures given indicate clearly the usual acceptance of these foods:

Generally, the children ate between 60 and 75 grams of eggs, meat, or other main dishes at their noon meal. The exceptions were broiled beef and liver loaf, of which less was served, and beef stew made with many vegetables and served as the main dish of the meal, of which they ate a larger quantity. Some other combination dishes, such as Spanish rice or liver and spaghetti, were not so well liked as might be expected, and eggs in the form of a soufflé were not eaten in as large a quantity as eggs served in other ways.

TABLE 1.—Weights of prepared foods consumed by children at the noon meal and midsession feedings at the nursery school¹

Kind of food	Weights taken of foods consumed by children aged—			Average weight of foods consumed by children aged—			Median weight of foods consumed by children aged—			Range of weights of foods consumed by children aged—		
	18 to 41 months	42 to 53 months	54 to 71 months	18 to 41 months	42 to 53 months	54 to 71 months	18 to 41 months	42 to 53 months	54 to 71 months	18 to 41 months	42 to 53 months	54 to 71 months
	Number	Number	Number	Grams	Grams	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Milk (noon).....	357	304	62	203	241	300	192	201	307	408	440	440
Milk (afternoon).....	215	194	62	182	188	196	199	199	198	243	239	216
Vegetables:												
Beets, buttered.....	30	20	2	43	44	49	44	45	---	68	75	51
Broccoli, buttered.....	9	3	---	22	22	---	24	20	---	30	28	---
Cabbage, celery, onion, buttered.....	20	14	---	40	33	---	38	33	---	112	46	---
Carrots, buttered.....	58	32	11	43	49	---	43	46	60	96	80	78
Peas, buttered.....	21	28	7	45	50	---	41	47	53	84	87	---
Potatoes, creamed.....	21	22	2	65	71	---	65	66	---	102	114	51
Potatoes, mashed.....	56	42	6	59	74	---	60	74	63	112	185	109
Potatoes, scalloped.....	45	35	6	52	60	---	52	61	64	119	95	97
Spinach, buttered.....	81	65	12	43	51	---	49	50	49	98	81	61
String beans, buttered.....	71	35	13	41	47	---	39	48	43	98	84	89
Tomatoes, scalloped.....	41	36	---	62	67	---	64	69	---	97	92	---
Tomato juice (morning).....	29	10	62	65	71	73	65	72	65	77	77	140
Fruit and other desserts:												
Apple brown betty.....	16	16	---	81	101	---	80	89	---	117	181	---
Apple sauce.....	26	25	3	108	106	105	100	101	91	212	198	140
Apple tapioca.....	12	8	2	102	107	52	88	99	---	192	175	80
Apricots, stewed.....	36	22	---	95	97	---	80	91	---	248	188	---
Apricot, tapioca.....	10	13	3	110	108	95	101	100	92	147	183	112
Apricot, whip with custard sauce.....	19	18	8	86	94	99	76	81	85	138	170	107
Baked custard.....	14	5	2	76	76	77	73	66	---	104	123	97
Bananas with custard sauce.....	12	12	---	120	104	---	103	81	---	262	166	---
Bananas with raisin sauce.....	13	11	3	81	84	103	90	80	106	114	114	124
Chocolate-cornstarch pudding.....	14	11	4	110	92	76	107	91	75	176	152	95
Date pudding.....	13	21	2	89	95	77	82	90	---	162	181	80
Fruit cup.....	10	7	---	106	119	---	99	98	---	178	192	---
Peaches, canned.....	16	17	6	94	91	91	80	90	86	157	158	154
Pineapple, tapioca.....	15	4	1	83	164	90	85	155	---	200	201	---
Prune custard.....	13	7	---	105	94	---	76	89	---	332	131	---
Prune betty.....	14	10	10	64	66	79	65	78	83	103	85	113
Prunes, stewed.....	21	16	2	84	86	49	85	85	---	148	150	96
Prune whip with custard sauce.....	19	26	5	73	108	79	76	91	81	157	400	---

Eggs, meat, fish, and other main dishes:

Eggs:										
A la goldenrod										
Fricassee	17	5	1	65	72	80	68	69	25-57	63-81
Hard cooked, creamed	13	10	2	62	67	64	65	67	30-76	47-75
Hard cooked, with tomato	8	10	2	67	63	64	67	65	44-54	55-72
Scrambled	11	22	5	46	72	64	61	71	50-110	34-120
Souffle	24	15	8	48	61	58	51	55	22-68	32-77
Beef, broiled	38	9	2	46	46	58	48	42	35-70	53-61
Beef stew with vegetables	36	22	5	28	25	35	27	28	8-31	33-36
Liver, creamed	16	18	3	119	144	135	133	136	24-170	97-208
Liver loaf	31	17	6	51	63	78	52	64	22-77	44-88
Liver and spaghetti	12	18	2	71	78	86	64	76	25-75	21-103
Meat loaf	15	8	2	49	42	53	48	42	48-97	44-156
Fish chowder	11	3	2	96	181	---	114	186	16-162	28-61
Salad	15	16	---	67	75	---	60	69	36-126	142-216
Salad, creamed	15	13	---	53	53	55	52	49	32-85	56-124
Tuna fish, creamed	24	12	3	63	62	71	63	67	47-89	32-83
Spanish rice	18	17	7	64	75	81	60	72	42-112	40-76
Lima beans and bacon	19	17	2	71	75	68	71	74	38-98	56-105
Lima beans and tomato sauce	10	9	2	67	64	---	67	60	40-91	53-109
Macaroni and tomato	9	2	---	52	62	---	52	---	22-100	63-64
Sandwiches:										
Apple	45	43	8	18	16	22	17	14	10-52	12-32
Cabbage	28	27	---	14	15	---	14	14	8-22	10-32
Carrot	45	45	5	16	15	25	16	14	5-32	10-30
Celery	37	46	---	16	14	---	14	12	10-42	8-28
Lettuce	58	50	5	14	15	22	12	14	6-30	10-26
Peanut butter	9	2	5	15	19	23	15	9	11-26	19-29
Bread and butter	58	78	21	12	11	15	10	10	7-36	7-24
Toast, buttered	16	5	12	10	14	11	9	12	4-16	12-16
Graham crackers (afternoon)	224	167	62	8	8	8	8	7	2-10	5-10

1 For some foods, data do not appear for every age group. This does not mean that these foods were not served, but that weights for these foods were not taken in every group.

Potatoes in different forms, and escalloped tomatoes were eaten in larger quantities than other vegetables. For the youngest age group the average consumption of potatoes in different forms ranged from 52 to 65 grams per child per meal (about 4 tablespoons); for escalloped tomatoes, the average was 62 grams. Of other vegetables the average weight eaten per meal ranged from 22 grams, of broccoli, to 45 grams (about 3 tablespoons) of carrots.

The average quantities eaten of desserts varied widely, with values usually slightly under 100 grams per child per meal. Sandwich servings were likely to weigh from 14 to 16 grams. At their noon meal children under $4\frac{1}{2}$ years usually ate one sandwich, while children in the oldest group, $4\frac{1}{2}$ to 6 years of age, averaged one and one-half servings.

About 200 grams (four-fifths cup) of milk were consumed both at noon and again at the midafternoon lunch by the younger groups. The oldest children ($4\frac{1}{2}$ to 6 years) drank a little more than 1 cup, an average of about 300 grams apiece, at noon and about 200 grams in the afternoon.

In the case of most foods, more was eaten by the older children than by the younger, although the differences were not large. The quantities of most foods eaten at the noon meal by children enrolled at the National Child Research Center seem to be smaller than those eaten by children of the Merrill-Palmer Nursery School (25). The upper limit of the range as shown in table 1 seldom exceeds the average reported from the Merrill-Palmer School for similarly prepared food. The only notable exception is in the case of milk, of which children at the research center drank more. Studies at the center, extending from October 1932 to March 1936, show that children under $4\frac{1}{2}$ years of age consumed an average of 1.9 cups and older children 2.2 cups per child at school. The average daily intake of milk at the Merrill-Palmer School was 1.2 cups.

At times an effort was made at the research center to increase the consumption of vegetables, but behavior problems almost invariably arose. In view of the generally satisfactory nutritive value of the diets (as shown later in this report) and the good physical condition of the children, it has seemed wiser to encourage as large servings as were readily acceptable, and to assure an adequate intake of all essential nutrients by careful planning of meals both at home and at school.

While table 1 shows that the quantities of the different foods actually eaten vary greatly from child to child and probably from time to time, these records indicate what may be expected of the food consumption of children of similar age groups and economic status. A careful study of the relation of the form in which a food is served to the total value of nutrients actually furnished by the food eaten should help in the planning of meals for children whose food intake is unsatisfactory.

Table 2 shows the quantities of different food materials actually eaten per 1,000 child-meals by children of three age groups. (These figures correspond to quantities eaten by 50 children in the 5 school days of a 4-week period.) The information is given in terms of individual foods to make it useful both to those responsible for child feeding, and to those who wish to analyze the data from points of view other than those presented in this report. With increasing age

and larger total consumption, children tend to drink more milk and to eat at their school meals more fats, potatoes, tomatoes, and leafy and green-colored vegetables.

In table 2 and in later tables the results of the studies are presented in two series; series 1, those made before October 24, 1932, and series 2, those made after that date. During the period covered by the studies of series 1, the food that the children were eating at school furnished somewhat less than half of what may be considered generous daily allowances of calcium, phosphorus, and iron. An attempt was made after October 1932 to improve the diet without adding much, if any, to its cost. The studies reported as series 2 represent this improved dietary.

ENERGY VALUE OF THE FOOD CONSUMED BY INDIVIDUAL CHILDREN AT HOME AND AT SCHOOL

Fifty-seven studies of total food intake, each covering 4 or 5 consecutive days, were made on 32 children between November 1931 and June 1933. The quantities of each food eaten at school meals were weighed to the nearest gram. The nutritive values of individual foods were computed directly from average figures on composition, chiefly according to Sherman's tables (24). The nutritive value of food mixtures or cooked dishes was computed on the basis of the weights of the component ingredients and the final weight of the cooked product. The quantity of the food consumed at home was recorded in common measures. Its energy value was estimated from the recipes used at home or from data on the composition of cooked food according to Rose (18).

The estimated total energy value of the food consumed per day is summarized for children in different age groups in table 3 and shown child by child in table 4. The mean energy value of the food consumed at home and at school amounted to 1,361, 1,287, and 1,451 calories per child per day for children aged 24 to 35 months, 36 to 47, and 48 to 59 months, respectively. Corresponding figures per kilogram of body weight were 96.8, 83.7, and 79.0 calories. Per inch of height, the food eaten furnished 38.2, 33.5, and 34.6 calories, respectively.

Table 3 shows also the interquartile range (the range within which the middle 50 percent of the cases fall). In estimating the probable consumption of similar groups of children such a range may be more informative than the range of all cases or than a single figure such as the mean or median. This range has been calculated for total calories, calories per kilogram of body weight, and calories per inch of body height for each age group.

Wide fluctuations may occur from day to day in the total energy intake of any individual child. (See also McKay and Patton (17).) The chief causes for this variation appear to be the form in which the food is served and the activity of the child. Individual differences in activity within a group of children are not closely correlated with either age or weight.

TABLE 2.—Average quantities of specified foods consumed per 1,000 child-meals at the nursery school

Foods (edible portion)	Series 1, children aged—		Series 2, children aged—		
	30 to 41 months	42 to 53 months	30 to 41 months	42 to 53 months	54 to 71 months
Milk, cheese, ice cream:	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Milk, whole fluid.....	753.8	730.8	930.5	1,073.4	1,146.2
Milk, dry skim.....			19.5	18.5	6.2
Cheese, cottage.....			.3	.5	
Ice cream.....		3.0			
Total.....	753.8	733.8	950.3	1,092.4	1,152.4
Vegetables and fruits:					
Potatoes:.....	34.4	45.7	41.7	45.2	60.8
Dried legumes and nuts:					
Lima beans.....	1.8		1.5	1.9	
Peanut butter.....			.1	.3	1.5
Total.....	1.8		1.6	2.2	1.5
Tomatoes:					
Canned or juice.....	18.4	1.8	43.9	59.0	171.4
Puree.....	10.1	8.8	4.9	14.2	11.3
Fresh.....	4.8			.2	1.3
Total.....	33.3	10.6	48.8	73.4	184.0
Green and leafy vegetables:					
Asparagus.....	3.3	1.9		1.2	
Broccoli.....	3.1	.8			
Cabbage.....	6.4	3.8	4.5	9.2	1.3
Kale, fresh.....		.5			
Lettuce.....	2.2	2.3	1.8	2.8	.2
Parsley.....	.5	.1	.1	.1	
Peas, canned.....	15.3	16.0	27.1	23.9	30.6
Peas, fresh.....		2.2			
Spinach, canned.....			2.0		
Spinach, fresh.....	22.7	31.9	21.9	27.9	38.2
String beans, canned.....	8.4	19.3	31.8	29.7	41.3
String beans, fresh.....	11.6	12.7		2.7	
Watercress, fresh.....	.1	.2			
Total.....	73.6	92.7	89.2	97.5	111.6
Yellow vegetables: Carrots.....	19.3	26.7	20.7	19.1	21.7
Other vegetables:					
Beets, canned.....	3.4	1.8	12.7	9.8	5.6
Beets, fresh.....	3.6	3.3			
Cauliflower.....		1.8			
Celery.....	3.9	5.1	2.8	2.9	
Onions.....	2.2	2.2	2.2	1.9	3.2
Turnips.....	.8	2.7	1.5	1.7	3.2
Total.....	13.9	16.9	19.2	16.3	12.0
Citrus fruits:					
Lemon juice.....	.4	.7	.2	.4	1.2
Oranges, orange juice.....	2.8	6.3	2.4	2.0	5.1
Total.....	3.2	7.0	2.6	2.4	6.3
Other fruits, fresh and canned:					
Apples.....		35.2	20.0	17.2	74.2
Applesauce.....			18.1	17.4	
Bananas.....	13.8	10.4	9.3	13.4	
Peaches, canned.....	.6	3.9	20.7	12.4	
Peaches, fresh.....	1.8	4.0			
Pears, canned.....			1.6		
Pears, fresh.....	11.0				
Pineapple, canned.....	2.2	2.6	3.3	3.1	3.8
Strawberries, fresh.....		.8			
Total.....	29.4	56.9	73.0	63.5	78.0

TABLE 2.—Average quantities of specified foods consumed per 1,000 child-meals at the nursery school—Continued

Foods (edible portion)	Series 1, children aged—		Series 2, children aged—		
	30 to 41 months	42 to 53 months	30 to 41 months	42 to 53 months	54 to 71 months
Vegetables and fruits—Continued.					
Fruits, dried:	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Apples.....	1.0	—	—	—	—
Apricots.....	11.7	7.0	8.4	8.9	7.4
Dates.....	3.8	4.8	1.8	2.4	3.7
Figs.....	—	—	.3	.7	—
Pears.....	.8	1.5	—	—	—
Prunes.....	11.3	15.6	9.3	13.6	7.7
Raisins.....	3.3	.7	1.0	1.6	—
Total.....	31.9	29.6	20.8	27.2	18.8
Eggs.....	29.3	34.4	25.6	27.0	23.6
Lean meat, poultry, fish:					
Beef, round, ground.....	9.3	17.7	17.6	12.1	16.6
Veal, leg, ground.....	2.6	2.3	.5	6.2	2.1
Liver, beef.....	10.2	10.1	10.0	10.5	2.1
Chicken.....	2.4	.5	—	—	—
Haddock, fillet.....	10.1	14.4	5.5	5.2	9.4
Salmon, canned.....	2.2	1.2	4.9	4.7	2.6
Tuna, canned.....	2.2	—	3.6	3.6	3.2
Total.....	39.0	46.2	42.1	42.3	36.0
Grain products:					
Bread and other baked goods:					
Bread, whole wheat.....	31.9	35.5	30.3	28.3	23.4
Cookies, lemon.....	—	.9	—	—	—
Cookies, molasses.....	—	.4	—	—	—
Cookies, oatmeal.....	—	1.4	—	—	—
Crackers, graham.....	12.8	16.2	17.3	16.5	18.1
Sponge cake.....	—	1.8	—	—	—
Total.....	44.7	56.2	47.6	44.8	41.5
Flour and other cereals:					
Corn meal.....	—	.2	—	—	—
Cornstarch.....	1.5	.5	.4	.7	.9
Macaroni and spaghetti.....	.7	2.4	.8	1.4	1.7
Rice, brown.....	1.7	1.4	1.1	2.9	2.3
Tapioca.....	1.1	1.0	1.4	1.8	2.7
White flour.....	3.5	4.6	3.6	4.2	4.2
Total.....	8.5	10.1	7.3	11.0	11.8
Fats:					
Butter.....	13.3	14.8	13.9	14.8	15.6
Bacon.....	.7	1.1	.2	.5	2.8
Total.....	14.0	15.9	14.1	15.3	18.4
Sugars and sweets:					
Sugar, white.....	3.2	6.8	—	—	—
Sugar, brown.....	7.3	6.6	9.3	9.4	12.4
Total.....	10.5	13.4	9.3	9.4	12.4
Jelly.....	—	1.8	—	—	—
Molasses.....	—	.3	—	—	—
Orange ice.....	—	3.0	—	—	—
Total.....	—	5.1	—	—	—
Other:					
Cocoa.....	—	.2	.2	.3	—
Gelatin.....	.1	.1	—	.1	.9
Soup stock.....	2.4	5.7	4.8	2.1	—
Tomato soup.....	—	1.2	—	—	—
Total.....	2.5	7.2	5.0	2.5	.9

TABLE 3.—Average physical measurements and estimated daily energy intake of children in different age groups

Age and sex group	Studies	Weight			Height			Total calories			Calories per kilogram of body weight			Calories per inch of body height		
		Mean	Median	Inter-quartile range	Mean	Median	Inter-quartile range	Mean	Median	Interquartile range	Mean	Median	Inter-quartile range	Mean	Median	Inter-quartile range
24 to 35 months:	Num- ber	Kilo- grams	Kilo- grams	Kilo- grams	Inches	Inches	Inches	Calo- ries	Calo- ries	Calories	Calo- ries	Calo- ries	Calories	Calo- ries	Calo- ries	Calories
	4	13.6	13.6	12.8-15.2	35.3	35.3	34.9-36.8	1,139	1,288	1,188-1,495	83.8	92.1	84.7-108.0	32.2	36.0	33.4-41.6
	13	14.3	14.3		35.8	35.8		1,431			100.8			40.0		
36 to 47 months:	Both	14.1	13.7	12.8-15.2	35.7	35.5	34.9-36.8	1,361	1,288	1,188-1,495	96.8	92.1	84.7-108.0	38.2	36.0	33.4-41.6
	12	16.0			39.0			1,290			81.0			33.0		
	7	14.7			37.4			1,284			88.2			34.3		
48 to 59 months:	Both	15.5	14.6	14.2-17.6	38.4	38.0	37.3-39.3	1,287	1,255	1,203-1,407	83.7	82.8	74.1-86.8	33.5	33.7	31.2-35.4
	9	18.1			41.4			1,387			76.6			33.4		
	12	18.9			42.4			1,499			80.8			35.4		
Both	21	18.5	17.8	16.7-20.2	41.9	42.0	40.6-43.4	1,451	1,426	1,311-1,635	79.0	79.6	68.8-85.7	34.6	33.5	32.0-39.5

TABLE 4.—Physical measurements and estimated average daily energy intake of individual children in different age groups

Age, sex, and individual study No. ¹	Date of study	Duration of study	Age	Height	Weight	Deviation from standard ²	Energy value of food eaten at and school			Proportion of total calories eaten at school
							Per day	Per kilogram of body weight	Per inch of body height	
24 to 35 months, girls:		<i>Days</i>	<i>Months</i>	<i>Inches</i>	<i>Kilo-grams</i>	<i>Percent</i>	<i>Calo-ries</i>	<i>Calo-ries</i>	<i>Calo-ries</i>	<i>Percent</i>
1a.....	April 1932.....	5	32.0	35.00	12.6	-4	930	73.8	26.6	43
2a.....	September 1932.....	5	26.0	34.25	13.0	+6	1,144	88.0	33.4	51
2b.....	February 1933.....	5	30.5	35.50	13.7	+3	1,261	92.0	35.5	46
2c.....	May 1933.....	5	34.0	36.50	15.0	+8	1,222	81.5	33.5	48
24 to 35 months, boys:										
3.....	November 1931.....	5	32.5	37.00	14.4	-1	1,173	81.5	31.7	40
4a.....	February 1932.....	5	24.5	34.75	13.4	+4	1,486	110.9	42.8	26
4b.....	October 1932.....	5	32.5	37.25	15.3	+5	1,503	98.2	40.4	29
5a.....	March 1932.....	5	30.0	35.00	11.0	-16	1,416	128.7	40.5	49
6.....	April 1932.....	5	29.5	35.00	12.5	-5	1,151	92.1	32.9	40
7a.....	October 1932.....	5	35.0	35.00	13.1	-1	1,375	105.0	39.3	38
8.....	do.....	5	33.0	35.75	14.2	+2	1,288	90.7	36.0	41
9a.....	December 1932.....	5	25.5	33.50	12.5	+4	1,203	96.2	35.9	42
9b.....	March 1933.....	5	28.5	34.25	13.1	+5	1,339	102.2	39.1	45
10a.....	January 1933.....	5	24.5	36.00	15.1	+11	1,827	121.0	50.8	34
10b.....	April 1933.....	5	28.0	37.00	16.0	+10	1,852	115.8	50.1	43
11a.....	January 1933.....	4	24.0	36.50	17.5	+24	1,281	73.2	35.1	44
11b.....	May 1933.....	4	27.5	37.75	18.1	+21	1,711	94.5	45.3	52
36 to 47 months, girls:										
12a.....	January 1932.....	5	42.5	37.50	14.2	-4	1,618	113.9	43.2	34
13a.....	May 1932.....	5	40.5	40.00	17.6	+7	1,415	80.4	35.4	40
12b.....	do.....	4	47.0	38.75	14.6	-4	1,255	86.0	32.4	42
14a.....	October 1932.....	5	39.0	37.50	13.7	-5	974	71.1	26.0	49
13b.....	do.....	4	46.5	41.50	18.2	+5	1,400	78.9	33.7	44
1b.....	November 1932.....	5	39.0	37.25	14.2	-1	1,053	74.2	28.3	46
15.....	November 1933.....	4	36.0	36.25	15.1	+10	1,055	69.9	29.1	36
16a.....	January 1933.....	5	43.5	41.00	19.9	+22	1,582	79.5	38.6	35
14b.....	February 1933.....	5	43.0	38.50	14.6	-4	1,218	83.4	31.6	53
1c.....	March 1933.....	5	43.0	38.00	14.3	-5	1,184	82.8	31.2	51
16b.....	April 1933.....	4	46.5	42.00	20.6	+16	1,500	72.8	35.7	45
14c.....	May 1933.....	5	46.5	39.25	15.0	-4	1,220	81.3	31.1	58
36 to 47 months, boys:										
17.....	November 1931.....	5	39.5	37.00	14.9	+2	1,235	82.9	33.4	34
18a.....	March 1932.....	5	41.0	37.25	14.3	-2	1,300	90.9	34.9	39
19a.....	June 1932.....	4	38.0	39.10	18.1	+7	1,333	73.7	34.1	44
5b.....	September 1932.....	5	36.0	36.50	12.3	-14	1,283	104.3	35.2	48
20.....	December 1932.....	4	39.0	39.00	15.9	0	1,407	88.5	36.1	39
5c.....	February 1933.....	5	41.5	37.75	13.3	-11	1,226	92.2	32.5	40
7b.....	do.....	5	39.5	35.50	14.2	+4	1,203	84.7	33.9	50
48 to 59 months, girls:										
21.....	April 1932.....	5	49.5	41.00	17.8	+6	1,310	73.6	32.0	45
12c.....	September 1932.....	5	51.0	40.00	15.3	-6	1,321	86.3	33.0	41
22a.....	do.....	5	50.5	40.25	16.6	+1	965	58.1	24.0	57
23a.....	October 1932.....	5	49.0	42.00	19.3	+9	1,491	77.3	35.5	40
22b.....	March 1933.....	5	56.0	41.25	17.6	+3	1,123	63.8	27.2	65
13c.....	April 1933.....	4	52.0	42.75	19.3	+6	1,552	80.4	36.3	49
23b.....	March 1933.....	5	53.5	43.25	21.2	+14	1,804	85.1	41.7	36
24.....	May 1933.....	5	52.5	43.00	19.3	+5	1,602	83.0	37.3	52
25.....	do.....	4	48.0	38.75	16.1	+5	1,311	81.4	33.8	54
48 to 59 months, boys:										
26.....	April 1932.....	5	52.5	41.00	18.7	+5	1,327	71.0	32.4	44
20b.....	October 1932.....	5	54.0	43.75	24.6	+28	1,366	55.5	31.2	43
27.....	do.....	5	53.0	43.50	20.7	+8	1,733	83.7	39.8	33
19b.....	November 1932.....	5	49.0	39.25	15.7	-2	1,264	80.5	32.2	60
28a.....	do.....	4	49.5	41.00	16.5	-5	1,622	98.3	39.6	45
29a.....	December 1932.....	5	54.5	41.50	17.7	+1	1,648	93.1	39.7	41
30a.....	January 1933.....	4	51.0	44.00	19.9	+4	1,289	64.8	29.3	40
31.....	April 1933.....	5	51.5	44.50	21.4	+7	1,426	66.6	32.0	42
28b.....	do.....	5	54.0	42.25	17.3	-4	1,670	96.5	39.5	48
32.....	May 1933.....	4	49.0	40.00	16.8	+3	1,339	79.7	33.5	57
30b.....	June 1933.....	5	53.0	45.25	20.0	-2	1,497	74.9	33.1	41
29b.....	do.....	5	60.0	42.50	17.3	-5	1,804	104.3	42.5	35

¹ Letters a, b, c indicate first, second, third study, respectively, on children studied more than once.² Average weight for height and age (Woodbury (27)).

Two children in the youngest age group were chiefly responsible for the high averages reported in these studies for this age group (tables 3 and 4). The two highest averages were for one boy (individual study Nos. 10a and 10b) whose food intake averaged 1,827 calories per day for a week in January 1933, and 1,852 for a week in April of the same year. His food consumption was also high when stated in terms of calories per kilogram, 121 and 116, and of calories per inch, 51 and 50, respectively. On the dates mentioned his weight for height was well over the Woodbury standard (27), 11 and 10 percent, respectively. His calorie intake per kilogram was exceeded only by that of a second boy (individual study No. 5a) whose weight for height was under the Woodbury standard by 16 percent.

Although other children consumed food in amounts comparable to that of the first boy mentioned either at school or at home, no other child showed such consistently high food consumption at both places. His record is mentioned in particular, not because he should be regarded as exceptional but rather because such good eaters may be expected in any group, or in any family, and their high demands should be provided for.

The figures for relatively poor eaters (those with a total calorie consumption of less than 1,100 per day) also are interesting when calorie intakes are considered in relation to weight and height. Calorie intake per kilogram of body weight, while much lower than the average for the age group, was sometimes as high as that observed for some individuals with much higher total intakes. Calories per inch of body height, however, were lower than average, and also lower than any other in the group. The child (individual No. 1a) in the youngest age group who had the lowest total calorie intake (930 calories) showed also the lowest intake in calories per inch (27) but not the lowest in calories per kilogram (74). Seven months later she had increased her total calorie intake to 1,053 per day (study No. 1b). This represented also an increase in calories per inch and per kilogram. Although slightly underweight, still she had made more than the expected gain in weight for the period and was in excellent physical condition.

It was suggested at the White House Conference on Child Health and Protection (26) that height may prove to be the best unit on which to base energy allowances for children. McKay and Patton (17) found that average calorie intake per inch for children of preschool age was remarkably uniform but that the values were lower than the White House standard of 35 to 37 calories per inch. Among the studies made at the research center only 18 percent of the cases fell within the range of 35 to 37 calories per inch; 30 percent were above, and 52 percent were below. The median intake was found to be 34 calories per inch and the interquartile range from 32.7 to 38.6 calories per inch. The highest and lowest values for the group indicate that the variation is wide within what may constitute a normal range. The intake of calories per inch of height seems to show no definite relation to age or sex.

The average food intake per kilogram of body weight decreased consistently with increasing age. The boys showed a higher average calorie intake per kilogram at each age level than did the girls, although the number of cases is too small to warrant definite conclusions.

The energy value of the food consumed by children enrolled at the research center is compared in table 5 with results of similar studies reported in the literature. These figures on the food-energy consumption of healthy American children, taken altogether, are probably the best available measure of their energy needs. A healthy child who is growing at a normal rate, who possesses a sufficient but not excessive store of subcutaneous fat, and who presents to an experienced examiner every evidence of good nutrition, probably is consuming calories according to his needs.

According to averages from most studies, the energy-giving food consumed afforded between 1,200 and 1,350 calories per day for children from 24 to 35 months of age; between 1,300 and 1,500 calories for children from 36 to 47 months; between 1,450 and 1,700 calories for children from 48 to 59 months; and between 1,600 and 2,000 for children from 60 to 71 months.

At present it would seem that these average figures on total energy consumption per child are about as satisfactory a basis for planning food service as figures on consumption per unit of weight or height. It is to be hoped that more satisfactory methods for judging nutritional status may be developed soon. They would help not only in estimating the nutritional condition of individual children, but would also make possible the development of more satisfactory criteria for evaluating diets and for estimating energy allowances.

NUTRITIVE VALUE OF MEALS SERVED AT THE NURSERY SCHOOL

The food eaten by well-nourished children of nursery-school age at their noon meal and in midsession feedings may be expected to furnish from 40 to 50 percent of the total daily calories. The children enrolled at the research center obtained an average of 43 percent (from 26 to 65 percent) of the calorie value of their entire diet at these meals (table 4). Rose and Borgeson (19) report for one group of children at the Manhattanville Nursery calorie intakes at school averaging 45 percent (from 29 to 54 percent) of that furnished by the total daily food supply, and for another group an average of 43 percent (from 30 to 58). Sweeny and Chatfield indicated that the Merrill-Palmer Nursery School planned to provide about half of the children's energy needs through food at school (25).

The nutritive value of the school meals served at the research center to children individually and in groups is shown in table 6. The figures for protein, fat, carbohydrate, calcium, phosphorus, iron, and vitamins A, B, C, and G were obtained by applying average figures on composition (6, 18, 24) to the portions of food consumed (food served minus identifiable plate waste). In the case of calories in the studies with groups of children, a further correction was made for small quantities of plate waste too conglomerate for identification, by deducting 5 calories for each gram of air-dried waste (2). This air-dried waste was not chemically analyzed; hence corresponding corrections are not made in the figures reported for protein, fat, and carbohydrate. The figures for calories are therefore lower than would be obtained by applying the factors, 4, 9, and 4, respectively, to the quantities of protein, fat, and carbohydrate reported.

The nutritive value of prepared dishes was computed on the basis of the composition of component ingredients. Although food preparation inevitably involves some losses for certain nutrients, the cooking methods used were chosen to reduce such losses to a minimum. For example, cooking time was kept as short as possible, and cooking water and juices were always utilized.

TABLE 5.—Average daily energy intake by age groups compared with earlier investigations

Age groups studied by various investigators	Cases studied	Average daily energy intake—			
		Per child	Per unit of body weight		Per inch of body height
			Pound	Kilogram	
	Number	Calories	Calories	Calories	Calories
24 to 35 months:					
This study.....	17	1,362	44	97	38
Goodhue ¹	2	1,246	41	90	-----
Holt and Fales (12).....	11	1,313	44	96	-----
McKay ² (16).....	12	1,209	41	90	34
McKay and Patton ³ (17).....	28	1,222	37	82	33
Rose and Borgeson ⁴ (19).....	3	1,168	39	86	⁵ 34
Sweeny and Chatfield (25).....	30	1,399	46	102	-----
White House Conference (26).....	{ ⁶ 16 ⁷ 13	1,222 1,192	-----	-----	35-37 36
36 to 47 months:					
This study.....	19	1,287	38	84	34
Goodhue ¹	3	1,380	35	77	-----
Holt and Fales (12).....	10	1,332	42	93	-----
McKay ² (16).....	6	1,429	40	87	37
McKay and Patton ³ (17).....	23	1,285	35	76	32
Rose and Borgeson ⁴ (19).....	5	1,292	38	84	⁵ 34
Sweeny and Chatfield (25).....	47	1,506	44	96	-----
White House Conference (26).....	{ ⁶ 16 ⁷ 17	1,268 1,348	-----	-----	35-37 37
48 to 59 months:					
This study.....	21	1,451	36	79	35
Goodhue ¹	6	1,617	37	82	-----
Holt and Fales (12).....	12	1,429	37	82	-----
McKay ² (16).....	7	1,721	40	89	41
McKay and Patton ³ (17).....	8	1,389	37	81	33
Rose and Borgeson ⁴ (19).....	7	1,473	39	85	⁵ 36
Sweeny and Chatfield (25).....	47	1,487	40	87	-----
White House Conference (26).....	{ ⁶ 20 ⁷ 18	1,455 1,510	-----	-----	35-37 38
60 to 71 months:					
Goodhue ¹	8	2,108	41	91	-----
Holt and Fales (12).....	10	1,649	40	89	-----
Rose and Borgeson ⁴ (19).....	8	1,386	40	87	⁵ 34
White House Conference (26).....	{ ⁶ 21 ⁷ 15	1,609 1,688	-----	-----	35-37 40
18 to 29 months:					
This study ⁸	10	1,441	46	101	41
Rose, Robb, and Borgeson ⁹ (20).....	58	1,275	44	97	⁵ 38
30 to 41 months:					
This study ⁸	19	1,265	40	89	34
Bray, Hawks, and Dye (5).....	19	1,260	34	74	-----
Rose, Robb, and Borgeson ⁹ (20).....	92	1,350	41	90	⁵ 36
42 to 53 months:					
This study ⁸	22	1,369	36	79	34
Bray, Hawks, and Dye (5).....	26	1,440	37	81	-----
54 to 65 months:					
Bray, Hawks, and Dye (5).....	15	1,526	35	77	-----

¹ GOODHUE, A. L. A STUDY OF THE DIETS OF HEALTHY CHILDREN FROM TWO TO SIX YEARS, BY THE INDIVIDUAL METHOD. [Unpublished master's thesis, Univ. Chicago.]

² Only children from private homes included.

³ Recalculated from 6-month tables for 12-month intervals.

⁴ Recalculated from tables including wider age range, on well children from fairly normal homes but with incomes probably lower than other groups represented here.

⁵ Calculated from height and total calorie figures.

⁶ Girls only.

⁷ Boys only.

⁸ Recalculated for comparison with age groups in following reports.

⁹ Medians used instead of means. Calories per inch based on median calorie consumption and median height.

Many circumstances influence the extent of absorption and utilization of the various nutrients. The utilization of minerals, for example, is influenced, among other factors, by the chemical combinations in which they are held, whether existing in the food as eaten or formed in the digestive tract. Since quantitative knowledge on these points is still fragmentary, no adjustments can be made in statistical analyses at present. When the needed data are available, revised estimates can be made of the average nutritive value of diets here described, inasmuch as average consumption of each article of food per 1,000 child-meals is reported in table 2.

No calculations have been made of the vitamin D content of diets, not because vitamin D is considered unimportant, but because this vitamin is usually supplied by concentrates and through sunshine. No cod-liver oil or other extra source of vitamins A or D was given at the nursery school. The parents were advised to give it at home and most of them consulted pediatricians who indicated the amount.

According to the figures in table 6, the appetites of the children increased steadily with increasing age. The boys ate slightly more than the girls, and in each group the children ate more of series 2 diets than of series 1. The series 2 diets were relatively higher in minerals and vitamins, and at every age level furnished from 40 to 50 percent of the calories needed for the day, and more than half of the protein, minerals, and vitamins.

From 15 to 18 percent of the calories furnished by the school meals were derived from protein. A large share of these calories came from milk and eggs—foods which contain an assortment of amino acids that help to supplement the proteins furnished by grain products and give the diet higher nutritive value. The school meals furnished well over half of the allowance of 3.2 grams of protein per kilogram of body weight suggested by Daniels and others (7).

About a gram each of calcium and phosphorus per day has long been regarded (8, 15, 22) as a fairly generous allowance for the young child. In series 1 the school meals were found to furnish barely half of these amounts. An effort was made therefore to assure higher calcium and phosphorus intakes, without adding much to food expenses.

To accomplish this, dry skim milk was added to the list of available foods during the period covered by studies called series 2. Most of the dry milk was used in cooking, in proportions that provided about 50 percent more of milk solids per quart of reconstituted milk than are contained in an equivalent amount of fresh skim milk. Some milk powder was also added to the milk served as a beverage.

At the same time, some further attention was given to the consumption of fluid milk. Mention has already been made of the relation between size of glass and volume of milk consumed (p. 4). Changing from 4-ounce to 7-ounce glasses apparently contributed to the intake of a larger volume of milk by the younger children from 1933 to 1935. A change from 7-ounce to 3½-ounce glasses in 1935-36 resulted in a decrease in the average volume of milk consumed.

By these means a marked increase in the calcium and phosphorus intake was effected, and as a result the school food furnished the children an average of from two-thirds to three-quarters gram each of calcium and phosphorus per day.

TABLE 6.—Average nutritive value of food consumed daily at school by children of different age groups

Age, sex, and series	Child-days	Energy value ¹	Protein	Fat	Carbo-hydrate	Calcium	Phosphorus	Iron	Vitamins			
									A	B	C	G
Average of individual studies (series 1 and 2 combined):	Number	Calories	Grams	Grams	Grams	Grams	Grams	Milli-grams	Inter-national Units ²	Inter-national Units ²	Inter-national Units ²	A. C. S. units ²
24 to 35 months:	55	520	22	23	56	0.53	0.53	4.1	2,800	(?)	350	370
Girls	55	545	24	24	59	.56	.55	4.2	3,500	(?)	390	380
Boys	130											
36 to 47 months:	171	550	24	24	59	.56	.54	4.1	3,100	(?)	400	380
Girls	106	565	25	25	60	.60	.59	4.5	3,200	(?)	410	410
Boys												
48 to 59 months:	80	665	30	30	69	.74	.69	4.7	3,800	(?)	430	470
Girls	112	690	31	30	73	.75	.71	5.1	4,200	(?)	490	540
Boys												
60 to 71 months:	55	715	31	33	74	.76	.72	5.4	3,800	(?)	480	520
Girls												
Boys												
Average of group studies (data for girls and boys combined):												
30 to 41 months:												
Series 1	892	520	21	23	59	.48	.49	3.9	2,700	130	330	340
Series 2	749	585	27	26	66	.69	.65	4.3	3,200	175	420	450
42 to 53 months:												
Series 1	715	560	23	24	66	.48	.50	4.2	3,200	145	410	360
Series 2	1,222	655	30	30	71	.77	.72	4.9	3,200	190	460	490
54 to 71 months:												
Series 2	112	700	30	33	70	.74	.73	4.6	3,900	180	650	450

¹ See text, p. 15.

² For description of vitamin units see Daniel and Munsell, "Vitamin Content of Foods," U. S. Dept. Agriculture Misc. Pub. No. 275 (June 1937), and Sherman and Smith, "The Vitamins," American Chemical Society Monograph series No. 6 (2nd Ed. 1931). In order to obtain vitamin values for a comprehensive list of foods, it was necessary to employ not only data determined directly in terms of International Units but also those expressed in Sherman units and determined prior to the establishment of International Standards of Reference (1931 and 1934). To arrive at an approximation of the International Unit value of data expressed in Sherman units, the Sherman unit values for vitamin A were divided by 2; the Sherman unit values for vitamin B₁ were divided by 2; and the Sherman unit values for vitamin C were multiplied by 10.

³ No values obtained.

Few data are available on the iron requirements of children. From balance studies reported in the literature (1, 8, 9, 14, 21) it appears that at least 0.35 milligram of iron per kilogram of body weight probably is required for normal growth and development, and that 0.60 milligram per kilogram permits generous retention.

For children enrolled at the research center these allowances would amount to a total of about 5 milligrams for 2-year old children to 6.5 milligrams daily for children between 4 and 5 years of age when computed according to the 0.35 milligram standard, and to a total of 8.5 to 11 milligrams for these age groups on the 0.60 milligram standard. In the series 1 studies, the food served to the youngest group at school supplied just under 4 milligrams of iron per child daily, an amount well over half of the lower allowance, but scarcely half of the larger. In order to provide an added margin of safety the further planning of the nursery-school meals was directed particularly toward inducing a higher intake of iron-rich foods.

In the nursery school meals of series 1, eggs, liver and other meat were already prominent, and most of the grain products were whole grain. Hence, the effort to increase the consumption of iron hinged on still further use of such iron-rich foods as prunes, apricots, and green, leafy vegetables.

As a result of this emphasis the average iron content of the food eaten at school was increased from 3.9 and 4.2 milligrams to 4.3 and 4.9 milligrams for the two younger groups, respectively. These latter figures are well over half of the smaller allowances suggested for these age groups (4.9 and 5.4 milligrams, respectively) and fully half of the larger allowances suggested (8.5 and 9.3 milligrams, respectively). Together with the iron furnished by the food eaten at home the iron provided probably adequately met the demands of growth as well as those for maintenance of normal body composition. This is the more likely since estimates of the total iron content of diets computed from tables on food composition tend to be lower than the true total value of food as eaten. Food tends to accumulate iron in the ordinary processes of food preparation.

The average vitamin A values of the meals eaten at the nursery school ranged from about 2,000 to 4,000 International Units³ (4,000 to 8,000 Sherman units daily) for children in the different age groups. These amounts probably represented more than half of the vitamin A furnished by ordinary food. They did not necessarily comprise half of the day's total intake, since most of the children were receiving cod-liver oil or some other concentrated form of vitamins A and D. As yet there is no general agreement as to minimal or optimal allowances of vitamin A for children, but the level of intake characteristic of the school food eaten by these nursery-school children is well above half of any allowance so far suggested (5, 11, 18).

The average vitamin B (B_1) content of the food eaten at school ranged from 130 to 190 International Units per day for children in the different age groups. The school meals furnished, then, about five times as much vitamin B as the Cowgill formula (4, 5) would indicate necessary to prevent beriberi in children of similar weight and food habits. The food eaten at the school probably was richer in vitamin B than the food eaten at home, but it would seem that the diets on the whole were fairly well supplied with vitamin B. Per kilogram of

³ For description of vitamin units see footnote 2, table 6.

body weight, the total daily vitamin B intake of the children, however, probably was less than 20 International Units, an estimate which Knott (13) has suggested for optimum retention in children.

The raw materials from which the nursery-school meals were prepared furnished from 350 to 650 International Units of vitamin C per child per day (35 to 65 Sherman units). These figures are higher than the values of the food as eaten, because some destruction of vitamin C was unavoidable in food preparation. The children's total daily intake (at school and at home) probably did not exceed twice these quantities, or from 700 to 1,000 International Units (70 to 100 Sherman units) per child per day. Daily allowances ranging from half as much to more than twice these latter quantities have been recommended by various workers (10, 18) for children of this age. Much more clinical and laboratory work needs to be done, however, to determine the human requirement of this nutrient.

The nursery-school meals provided averages of from 340 to 520 Sherman units of vitamin G per child, or approximately 30 Sherman units per kilogram of body weight. As yet there are no laboratory or clinical data available to indicate the requirement for vitamin G. The quantity provided here is more than half of that which can readily be furnished a child daily through ordinary food.

The individual and group variations in the nutritive value of the food may be seen in tables 9 and 10 in the appendix.

DISTRIBUTION OF CALORIES AMONG SPECIFIED CLASSES OF FOOD

One satisfactory and practical method for planning adequate diets is that suggested by Rose (18) based on the distribution of calories among specified classes of foods. Her recommended distribution for children 3 to 5 years of age is based upon actual diets of children who showed uniform progress in health during a period of study and whose calculated daily consumption of protein, minerals, and vitamins compared satisfactorily with dietary standards.

This suggested distribution may be used not only in planning diets for children but also offers one method of evaluating food consumption. A daily diet that conforms to this distribution may be expected to meet the nutritive requirements of the child, if the energy intake is approximately normal, and if there is a reasonable variety of representative foods within certain groups.

On the other hand, a diet may fail to conform to the suggested distribution and yet may contain foods that provide satisfactory amounts of all essential nutrients. For instance, McKay and Patton (17) have reported average distributions that differ considerably from those suggested by Rose, but which apparently provided all essential substances in amounts sufficient to produce good growth and well-being in the children studied by them. Frequently, an estimate of the desirability of a certain distribution can be made by observing whether its deviations from the suggested standard tend to make the diet relatively richer or poorer in essential nutrients.

Table 7 shows that in general the energy value of the food served at the nursery school was slightly less than that of food served at home. In the food served at school more than half of the energy value came from milk, and less than half from cereals, vegetables, fruits, fats, sugars, and meat combined.

TABLE 7.—*Estimated energy value of food consumed per child at school and at home and percentage of calories derived from different food groups, compared with distribution suggested by Rose (18)*

Food consumed by children in different age groups	Energy value per child per day	Percentage of calories derived from—						
		Milk	Vegetables and fruits	Eggs, meat, fish	Foods from cereal grains		Fats	Sugars
					Highly refined	Other		
At school, group studies, series 2:	Calories	Percent	Percent	Percent	Percent	Percent	Percent	Percent
30 to 41 months.....	585	53.0	15.7	6.8	-----	13.9	8.0	2.6
42 to 53 months.....	655	54.8	16.0	6.6	-----	12.5	7.8	2.3
54 to 71 months.....	680	52.2	15.0	9.8	-----	12.0	8.0	3.0
Average.....	-----	54.0	15.9	6.8	-----	13.0	7.9	2.5
At home, individual studies:								
24 to 35 months:								
Girls.....	600	30.7	31.1	11.0	4.8	12.8	6.2	3.4
Boys.....	842	39.9	18.3	6.2	9.2	10.5	9.4	6.5
36 to 47 months:								
Girls.....	726	42.6	15.2	6.9	13.5	5.7	9.5	6.6
Boys.....	743	46.6	17.9	7.7	9.3	2.9	7.6	8.0
48 to 59 months:								
Girls.....	723	47.9	15.9	7.6	13.2	2.0	8.1	5.3
Boys.....	852	42.9	17.2	8.2	11.8	6.3	7.6	6.0
Average.....	-----	42.6	17.8	7.4	11.0	6.6	8.4	6.2
Rose's suggested distribution of calories (18).....	-----	45-60	10-18	3-6	18-25		3-8	1-5

In reporting on the distribution of calories in the food consumed by children at home, it seemed of interest to separate the whole grain and the highly refined grain products, since lightly milled grains are richer than the highly refined products in certain important nutrients, particularly in iron and vitamin B. In some of the homes relatively large proportions of the grain products served were highly refined. As has been noted previously, the cereal products used at school were practically all derived from the whole grain; the use of refined cereals was almost negligible.

A comparison of the improved school diet and the home diet with Rose's (18) suggestions for a low-cost diet for nursery-school children follows:

The milk taken at home furnished slightly less than the lower limit of the suggested allowance of 45 to 60 percent of the calories, while that at school supplies a calorie value falling within the upper half of this range. The volume of milk taken at home amounted to 1.9 cups per child, or almost 1 pint daily. At school the average milk consumption before October 1932 averaged 1.4 cups. After this date (series 2 studies) the average daily milk consumption at school, including the dry skim milk used, was equivalent to 2.1 cups of fluid milk. The total daily consumption, therefore, under the present dietary regime amounts to about 4 cups, or 1 quart, daily.

The calories furnished by the fruits and vegetables served at home were slightly higher than those furnished by the fruits and vegetables at school. Both, however, were close to the upper limit of the suggested range. The vegetables served at school did not include a high percentage of potatoes, and hence furnished fewer calories in proportion to their volume. Since they were chosen to be relatively high in minerals and vitamins, the quantity was ample.

Eggs, meat, and fish supplied a somewhat higher proportion of the calories both at home and at school than the suggested allowance.

In home meals the proportion of calories from grain products was slightly below the suggested 18 to 25 percent. About three-eighths of these calories came from whole and five-eighths from refined grain products. The school diets, while providing considerably less than the suggested percentage, contain very little of refined grain products.

The calories derived from fats were equal to or above the upper limit of the suggested range in both the home and school meals.

Sweets were within the suggested range in school meals but ran more than twice as high in those served at home.

In general, the diets of these nursery-school children were higher in sugar and in foods of animal origin, and probably represent a slightly more expensive diet than Rose (18) suggests.

Without increasing total costs, the diets of these children might be still further enriched particularly as regards iron and vitamin B, by making certain changes. In school meals, somewhat less fat and somewhat more whole-grain products could be used and some of the sugar could be replaced by molasses or unrefined sirups. In home meals, sugar and fat might well be reduced in favor of more potatoes and cereals in the less highly milled forms. Since the total daily protein supply of the diets is high, the quantities of high-protein foods might be somewhat reduced, provided they be replaced by iron-rich fruits, vegetables, or lightly milled grain products, and provided that the reduction be chiefly in the muscle meats rather than in eggs and liver. These latter foods are important in children's diets for their vitamin values as well as for iron and protein.

COST OF FOOD SERVED AT THE NURSERY SCHOOL

Questions are often raised as to the cost of serving noon meals at nursery schools. Table 8 presents figures on total disbursements by the research center for food over a 6-year period and the allocation of this money to different types of food.

TABLE 8.—*Expenditures for food and distribution of expenditures among specified foods at the National Child Research Center, 1931-37*

Year	Total expenditure	Percentage of total expenditure allocated to—										Meals served to—		Cost per meal		
		Milk	Vegetables and fruits	Eggs	Liver	Muscle meat and fish	Bread and flour	Butter	Sugars	Adult food and miscellaneous items		Adults	Children	Per unit	Per adult	Per child
	<i>Dol.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>		<i>No.</i>	<i>No.</i>	<i>Ct.</i>	<i>Ct.</i>	<i>Ct.</i>
1931-32-----	1,118	26	30	9	2	13	7	7	2	4						
1932-33-----	1,136	30	32	9	2	10	7	6	1	3						
1933-34-----	833	39	24	8	3	8	8	6	1	3	1,983	6,230		4.8	10.3	10.0
1934-35-----	496	36	28	9	2	8	7	6	1	3	1,129	3,022		5.9	12.5	11.7
1935-36-----	628	30	29	10	3	10	7	7	1	3	1,547	4,329		5.7	12.0	10.1
1936-37-----	938	30	33	10	3	8	5	7	1	3	1,827	5,038		7.4	15.5	12.8

An accurate estimate of the cost of the children's meals, separate from that for adults, presents difficulties, but an approximation has been made for the years 1933 to 1937 as follows:

From expenditures for all food were deducted the expenditure for milk, consumed almost entirely by the children, and the expenditures for tea, coffee, and small amounts of other foods used entirely by adults. The cost of a "unit meal" without milk or adult foods was then calculated.

The cost of one unit meal was added to the cost per child for milk to give the total cost of meal per child. This actually is a trifle high as it includes the milk used in cooked foods that the adults ate. Since the food-consumption studies showed that an adult served noon meals ate about twice as much of each prepared food as did a child, each adult meal served was considered as equivalent to two unit meals insofar as the prepared foods were concerned. The cost of a meal per adult was obtained by adding to twice the cost of a unit meal the per-capita cost of special adult food.

On this basis the cost of food served at the school amounted per child to 10.0, 11.7, 10.1, and 12.8 cents daily and per adult to 10.3, 12.5, 12.0, and 15.5 cents daily for the years 1933-34, 1934-35, 1935-36, and 1936-37, respectively. Similar figures for 1931-33 cannot be given because the records on number of meals served are incomplete.

From one year to another the greatest variations in expenditures for different types of food occurred in milk and in vegetables and fruits. These variations reflect not only changes in the relative prices of the different food groups, but also changes in the form in which the food was purchased, the type of store patronized, and quantity of food purchased at one time. Although most of the time food was bought from retail outlets, the type of store patronized varied. Sometimes it was possible to make purchases at a cash-and-carry market. At other times credit and delivery were required. During certain periods vegetables and fruits were purchased at a farmers' market, and at irregular intervals it was possible to buy milk at wholesale rates.

These fluctuations in buying practices coupled with a varying emphasis upon choosing foods which give unusually good returns in nutritive value for the money spent explain why diets fairly uniform in nutritive value do not reflect closely trends in retail prices such as are indicated by the index numbers of the U. S. Bureau of Labor Statistics. While the retail food indexes for 1933-34, 1934-35, and 1935-36 were 85, 93, and 96 percent, respectively, of the 1936-37 levels, the cost of food served to each child in the same years was 66, 81, and 77 percent of the 1936-37 levels.

As a rule, about one-third of the expenditures for food went for milk, from one-fourth to one-third for vegetables and fruits, about one-fifth for eggs, liver, muscle meat, and fish, and the rest for bread, butter, sugar, and miscellaneous items. These proportions are suitable for a moderate-cost diet, but are not applicable to a very low-cost diet plan. In the latter more emphasis would be put on breads and cereals. Probably the proportions spent for milk, fruits, and vegetables could be reduced without reducing the quantity or the nutritive value of the diet, if care were taken to select the less expensive forms of these items.

SUMMARY AND CONCLUSIONS

This report describes the type of meals served during a 5-year period to children, ranging in age from 24 to 71 months, enrolled at the National Child Research Center, Washington, D. C.

Quantitative studies were based on observations made both at school and at home. The school observations included both individual children and groups classified according to age; the home observations were confined to individual children.

A total of 57 group studies were made as follows: 24 on children from 24 to 41 months of age, 29 on children from 42 to 53 months, and 4 on children from 54 to 71 months. A total of 154 individual studies were made at school in addition to 57 studies of individual children both at home and at school. All studies covered periods of from 3 to 5 days each.

The food which the children ate at school supplied about 43 percent of the calories needed for the entire day, and half or more of what may be considered generous allowances of protein, minerals, and vitamins. Figures on the total energy intakes of the individual children in this study emphasize the wide differences in the food consumption of normal children. The averages, however, are very similar to those in previously published studies on well-nourished American children. The median calorie intakes per day found in the studies here reported were 1,288, 1,255, and 1,426 calories per child in the three age groups studied.

These data, in conjunction with those in the literature, indicate that normal American children from 2 to 3 years of age usually consume food furnishing from 1,200 to 1,350 calories per day; children from 3 to 4 years, 1,300 to 1,500 calories; children from 4 to 5 years, 1,450 to 1,700 calories; and children from 5 to 6 years, 1,600 to 2,000 calories per day.

The variation in calories per inch of body height is greater than similar variations reported by the White House Conference on Child Health and Protection (26).

At a moderate cost, noon meals such as are described, together with midsession feeding, may be expected to yield per child per day approximately from two-thirds to three-fourths gram each of calcium and phosphorus, from 4 to 5 milligrams of iron, from 2,000 to 4,000 International Units of vitamin A (4,000 to 8,000 Sherman units), from 130 to 190 International Units of vitamin B (B_1), from 350 to 650 International units of vitamin C (35 to 65 Sherman Units), and from 350 to 500 Sherman units of vitamin G.

The diets of the children studied, while already apparently adequate according to prevailing standards, might be even more liberally supplied with essential nutrients and offer a more liberal margin against possible deficiency without increasing expense if certain further modifications in present practice were made. Among these are the more extensive use in home meals of lightly milled grain products rather than the exclusive use of highly refined products; the more extensive use of other iron-rich foods in place of some of the muscle meat and fish; some reduction in the use of sugar and the replacement of part of the refined sugar with molasses or cane or sorgo sirups.

The average daily cost of the food served at the nursery school amounted to 10.0, 11.7, 10.1, and 12.8 cents per child; and 10.3, 12.5, 12.0, and 15.5 cents per adult, as estimated from the studies in 1933-34, 1934-35, 1935-36, and 1936-37, respectively. These differences reflect changing retail food prices less than changes in food choices and in food-buying practices.

LITERATURE CITED

- (1) ASCHAM, LEAH
1935. A STUDY OF IRON METABOLISM WITH PRESCHOOL CHILDREN. *Jour. Nutrition* 10: 337-342.
- (2) BENEDICT, FRANCIS G., and FARR, A. GERTRUDE
1931. THE ENERGY AND THE PROTEIN CONTENT OF EDIBLE FOOD WASTE AND MIXED MEALS IN SORORITY AND FRATERNITY HOUSES. *N. H. Agr. Expt. Sta. Bull.* 261, 35 pp., illus.
- (3) BRAY, M. M., HAWKS, J. E., and DYE, M.
1934. FOOD CONSUMPTION OF PRESCHOOL CHILDREN. *Jour. Amer. Dietetic Assoc.* 10: 309-316.
- (4) COWGILL, GEORGE R.
1934. THE VITAMIN B REQUIREMENT OF MAN. 261 pp., illus. New Haven and London.
- (5) ———
1937. THE VITAMIN REQUIREMENTS OF MAN. *Jour. Amer. Dietetic Assoc.* 13: 195-214, illus.
- (6) DANIEL, ESTHER PETERSON, and MUNSELL, HAZEL E.
1937. VITAMIN CONTENT OF FOODS. A SUMMARY OF THE CHEMISTRY OF VITAMINS, UNITS OF MEASUREMENT, QUANTITATIVE ASPECTS IN HUMAN NUTRITION, AND OCCURRENCE IN FOODS. *U. S. Dept. Agr. Misc. Pub.* 275, 176 pp.
- (7) DANIELS, AMY L., HUTTON, MARY K., KNOTT, ELIZABETH M., WRIGHT, OLIVE E., EVERSON, GLADYS J., and SCOU-LAR, FLORENCE
1935. A STUDY OF THE PROTEIN NEEDS OF PRESCHOOL CHILDREN. *Jour. Nutrition* 9: 91-107, illus.
- (8) ——— HUTTON, MARY K., KNOTT, ELIZABETH M., WRIGHT, OLIVE E., and FORMAN, MARY
1935. CALCIUM AND PHOSPHORUS NEEDS OF PRESCHOOL CHILDREN. *Jour. Nutrition* 10: 373-388, illus.
- (9) ——— and WRIGHT, OLIVE E.
1934. IRON AND COPPER RETENTIONS IN YOUNG CHILDREN. *Jour. Nutrition* 8: 125-138.
- (10) EVERSON, GLADYS J., and DANIELS, AMY L., with the cooperation of SCOU-LAR, FLORENCE, and DEARDORFF, M. F.
1936. VITAMIN C STUDIES WITH CHILDREN OF PRESCHOOL AGE. *Jour. Nutrition* 12: 15-26.
- (11) GUILBERT, H. R., MILLER, R. F., and HUGHES, E. H.
1937. THE MINIMUM VITAMIN A AND CAROTENE REQUIREMENT OF CATTLE, SHEEP, AND SWINE. *Jour. Nutrition* 13: 543-564.
- (12) HOLT, L. ENNETT, and FALES, HELEN L.
1921. THE FOOD REQUIREMENTS OF CHILDREN. I. TOTAL CALORIC REQUIREMENTS. *Amer. Jour. Diseases Children* 21: 1-28, illus.
- (13) KNOTT, ELIZABETH M.
1936. A QUANTITATIVE STUDY OF THE UTILIZATION AND RETENTION OF VITAMIN B BY YOUNG CHILDREN. *Jour. Nutrition* 12: 597-611, illus.
- (14) LEICHSENRING, JANE M., and FLOR, IVA HANSEN
1932. THE IRON REQUIREMENT OF THE PRESCHOOL CHILD. *Jour. Nutrition* 5: 141-146.
- (15) LEITCH, I.
1937. THE DETERMINATION OF THE CALCIUM REQUIREMENTS OF MAN. *Nutrition Abs. and Rev.* 6: 553-578, illus.
- (16) MCKAY, HUGHINA
1926. THE PHOSPHORUS INTAKE OF PRE-SCHOOL CHILDREN AS SHOWN BY A DIETARY STUDY MADE BY THE INDIVIDUAL METHOD. *Ohio Agr. Expt. Sta. Bull.* 400, pp. 387-425, illus.

- (17) McKAY, HUGHINA, and PATTON, M. B.
1935. A STUDY OF THE FOOD HABITS AND PHYSICAL DEVELOPMENT OF PRE-SCHOOL CHILDREN OVER A TWO-YEAR PERIOD, WITH SPECIAL REFERENCE TO SEASONAL VARIATIONS IN GROWTH. Ohio Agr. Expt. Sta. Bull. 549, 72 pp., illus.
- (18) ROSE, MARY SWARTZ
1937. A LABORATORY HANDBOOK FOR DIETETICS. Ed. 4, 322 pp., illus. New York.
- (19) ——— and BORGESON, GERTRUDE M.
1935. CHILD NUTRITION ON A LOW-PRICED DIET, WITH SPECIAL REFERENCE TO THE SUPPLEMENTARY VALUE OF AN EGG A DAY, THE EFFECT OF ADDING ORANGE JUICE AND OF REPLACING EGG BY LIVER. 109 pp., illus. New York. (Columbia Univ., Teachers Col. Child Devlpmt. Monog. 17.)
- (20) ——— ROBB, ELDA, and BORGESON, GERTRUDE M.
1932. THE FOOD CONSUMPTION OF NURSERY SCHOOL CHILDREN. Child Devlpmt. 3: 29-42.
- (21) ——— VAHLTEICH, ELLA McC., ROBB, ELDA, and BLOOMFIELD, EMILY M.
1930. IRON REQUIREMENTS IN EARLY CHILDHOOD. Jour. Nutrition 3: 229-235.
- (22) SHERMAN, H. C., and HAWLEY, EDITH
1932. CALCIUM AND PHOSPHORUS METABOLISM IN CHILDHOOD. Jour. Biol. Chem. 53: 375-399.
- (23) ——— and SMITH, S. L.
1931. THE VITAMINS. Ed. 2, 575 pp., illus. New York.
- (24) SHERMAN, HENRY C.
1937. CHEMISTRY OF FOOD AND NUTRITION. Ed. 5, completely rewritten, 640 pp., illus. New York.
- (25) SWEENEY, MARY E., and CHATFIELD, CHARLOTTE
1932. MIDDAY MEALS FOR PRE-SCHOOL CHILDREN IN DAY NURSERIES AND NURSERY SCHOOLS. U. S. Dept. Agr. Cir. 203, 47 pp.
- (26) WHITE HOUSE CONFERENCE ON CHILD HEALTH AND PROTECTION.
1932. GROWTH AND DEVELOPMENT OF THE CHILD . . . SECTION 1, MEDICAL SERVICE, PART III, NUTRITION. 532 pp. New York.
- (27) WOODBURY, ROBERT MORSE
1921. STATURES AND WEIGHTS OF CHILDREN UNDER SIX YEARS OF AGE. U. S. Children's Bureau Pub. 87, 117 pp., illus.

APPENDIX

TABLE 9.—Average nutritive value per day of food consumed at school by individual children in different age groups

Age, sex, and identification No. ¹	Days observed	Energy	Protein	Fat	Carbo- hydrate	Calcium	Phos- phorus	Iron	Vitamin A	Vitamin C	Vitamin G
24 to 35 months, girls:											
Series 1:	Number	Calories	Grams	Grams	Grams	Grams	Grams	Milli- grams	Inter- national Units ²	Inter- national Units ²	A. C. S. units ²
33a.....	3	315	12	12	39	0.26	0.28	3.6	2,400	250	200
33b (G 8).....	4	335	15	15	37	.27	.63	3.0	3,100	300	260
1d.....	5	330	14	14	37	.29	.30	3.2	2,900	320	250
1e (G 6).....	5	400	18	19	39	.43	.41	4.3	(3)	(3)	(3)
2a (G 10).....	5	580	23	22	72	.46	.53	5.3	(3)	(3)	(3)
Total or average.....	22	390	16	16	45	.34	.42	3.9	2,800	290	240
Series 2:											
34a.....	5	715	32	32	74	.78	.71	4.7	3,200	380	510
35a.....	5	615	27	29	61	.70	.64	3.6	2,700	430	440
36a.....	4	640	28	28	68	.72	.67	5.8	3,700	430	470
78.....	4	545	24	24	58	.52	.54	4.2	2,200	310	410
79.....	5	490	22	22	51	.51	.50	3.5	2,700	370	360
2b (G 16).....	5	585	25	26	63	.63	.60	3.9	(3)	(3)	(3)
2c (G 22).....	5	595	25	26	65	.61	.58	4.1	(3)	(3)	(3)
Total or average.....	33	595	26	27	63	.64	.61	4.3	2,900	390	440
Total or average (series 1 and 2 combined).....	55	520	22	23	56	.53	.53	4.1	2,800	350	370
24 to 35 months, boys:											
Series 1:											
44.....	3	400	14	14	54	.32	.34	2.6	2,500	290	230
54.....	4	380	15	15	44	.29	.32	4.2	4,300	370	310
59.....	4	315	16	15	36	.27	.32	2.6	2,600	280	190
51 (G 9).....	4	305	15	15	40	.28	.32	3.0	3,000	300	240
61.....	5	315	14	13	43	.25	.32	4.0	2,400	290	250
31b.....	5	290	12	12	32	.26	.28	2.8	2,300	290	230
37.....	3	345	13	10	35	.35	.38	4.2	2,300	510	520
39a.....	4	375	18	16	43	.29	.33	3.2	2,800	350	200
3 (G 2).....	4	405	19	21	40	.47	.46	3.8	(3)	(3)	(3)
4b (G 5).....	5	385	17	18	38	.42	.30	4.3	(3)	(3)	(3)
53 (G 25).....	5	690	30	32	70	.83	.73	3.5	(3)	(3)	(3)
63 (G 6).....	5	455	20	21	47	.37	.45	4.2	(3)	(3)	(3)
73 (G 11).....	5	530	22	22	61	.45	.47	3.7	(3)	(3)	(3)
83 (G 12).....	5	525	21	22	61	.46	.47	3.7	(3)	(3)	(3)
4b (G 12).....	5	430	19	10	46	.36	.39	3.3	(3)	(3)	(3)
Total or average.....	66	425	18	18	48	.39	.40	3.5	3,300	330	290

TABLE 9.—Average nutritive value per day of food consumed at school by individual children in different age groups—Continued

Age, sex, and identification No.	Days observed	Energy	Protein	Fat	Carbo- hydrate	Calcium	Phos- phorus	Iron	Vitamin A	Vitamin C	Vitamin G
24 to 35 months, boys—Continued.											
Series 2:	Number	Calories	Grams	Grams	Grams	Grams	Grams	Milli-grams	Inter- national Units	Inter- national Units	A. C. S. units
11c	5	710	34	35	65	0.74	0.75	5.2	3,900	520	510
41a	5	710	31	33	73	.71	.83	6.1	3,300	380	540
41b	5	740	35	34	75	.90	.90	7.1	4,000	440	630
42a	5	680	29	32	70	.72	.68	4.7	3,700	470	470
42b	4	680	28	28	61	.70	.64	4.4	3,600	490	440
43a	4	670	28	26	57	.63	.59	4.1	3,300	440	440
44a (G 15)	4	570	27	26	60	.62	.60	4.9	4,600	490	390
44b	3	620	26	28	66	.50	.53	4.2	3,200	410	360
83	5	530	23	24	58	.62	.57	3.5	(^a)	(^a)	(^a)
9a (G 14)	5	500	24	19	58	.72	.72	4.4	(^a)	(^a)	(^a)
10a (G 35)	5	630	30	26	69	.76	.76	4.4	(^a)	(^a)	(^a)
11a (G 15)	4	565	24	23	66	.51	.51	3.4	(^a)	(^a)	(^a)
9b (G 18)	5	600	31	26	61	.79	.75	4.2	(^a)	(^a)	(^a)
10b (G 20)	5	800	38	32	90	.92	.92	6.0	(^a)	(^a)	(^a)
11b (G 21)	4	860	34	39	94	.83	.80	5.4	(^a)	(^a)	(^a)
Total or average	64	655	30	29	69	.71	.69	4.8	3,700	450	470
Total or average (series 1 and 2 combined)	130	545	24	24	59	.56	.55	4.2	3,500	390	380
36 to 47 months, girls:											
Series 1:											
13d (G 3)	5	315	12	13	38	.24	.26	2.7	2,700	250	220
13e	5	415	16	18	47	.34	.36	1.1	2,800	300	280
22c	5	325	15	15	33	.29	.32	2.7	2,900	260	270
22d (G 4)	5	410	16	17	48	.30	.34	3.5	2,500	290	270
22e (G 3)	5	360	14	13	46	.27	.29	3.1	2,800	280	240
22f	4	450	17	18	55	.31	.35	3.7	4,100	530	320
22g	5	410	15	16	51	.30	.33	2.6	2,200	390	220
23c (G 7)	5	455	20	19	51	.44	.44	3.8	3,600	520	340
23d (G 8)	5	400	18	18	41	.33	.38	3.9	3,600	370	290
44	4	390	16	16	44	.33	.36	3.4	1,500	300	310
12a (G 4)	5	550	22	23	64	.48	.49	4.2	(^a)	(^a)	(^a)
13a (G 7)	5	560	25	25	58	.60	.57	4.0	(^a)	(^a)	(^a)
12b (G 27)	4	530	21	23	60	.46	.47	4.0	(^a)	(^a)	(^a)
14a (G 11)	5	475	19	20	55	.42	.44	4.0	(^a)	(^a)	(^a)
Total or average	67	435	18	18	49	.37	.39	3.3	2,900	350	280

Series 2:											
15b (G 20)	3	550	23	24	69	.62	.55	5.2	2,800	390	420
34b	5	745	31	35	77	.77	.72	6.7	4,300	550	540
35b	5	465	18	36	56	.41	.42	3.6	3,300	300	300
36b	5	360	23	24	63	.51	.53	4.1	3,300	370	440
43	5	625	30	32	63	.70	.64	4.1	3,900	380	440
46a	5	600	30	32	73	.73	.69	4.7	3,800	310	420
46b	5	675	30	32	69	.69	.63	4.5	3,300	470	420
47	5	680	29	31	71	.70	.63	4.9	3,300	490	420
48	5	655	28	32	73	.73	.69	4.5	3,700	410	420
49	4	710	32	32	69	.73	.70	4.5	3,600	590	480
50	5	685	30	32	66	.77	.70	4.5	3,600	340	440
51	5	770	22	33	77	.77	.71	4.8	3,300	400	510
52	5	725	26	33	75	.77	.70	4.8	2,900	390	420
53	4	640	28	30	68	.70	.66	3.8	1,600	270	520
54a	4	670	27	31	71	.64	.61	4.1	(3)	(3)	(3)
13b (G 32)	4	675	27	21	57	.47	.51	3.7	(3)	(3)	(3)
1a (G 13)	5	345	18	18	37	.47	.42	2.7	(3)	(3)	(3)
13a (G 35)	4	385	18	18	37	.47	.42	2.7	(3)	(3)	(3)
16a (G 36)	4	585	25	24	69	.62	.56	4.3	(3)	(3)	(3)
14b (G 16)	5	600	31	20	73	.89	.73	4.5	(3)	(3)	(3)
1b (G 18)	5	610	26	26	63	.82	.73	4.2	(3)	(3)	(3)
16b (G 41)	4	670	22	21	63	.81	.72	4.6	(3)	(3)	(3)
14c (G 22)	5	680	32	27	77	.79	.70	5.5	(3)	(3)	(3)
Total or average	104	625	28	28	65	.69	.64	4.5	3,300	430	450
Total or average (series 1 and 2 combined)	171	550	21	21	59	.56	.54	4.1	3,100	400	380
Series 1:											
30 to 47 months, boys:											
Series 1:											
17b	5	360	14	14	44	.27	.30	2.3	2,200	330	200
17c	5	355	16	15	40	.30	.31	2.9	2,600	260	290
18c	5	410	18	10	47	.30	.36	3.8	2,000	320	300
35b (G 24)	3	500	21	20	58	.48	.40	2.9	2,800	280	250
36a	5	505	21	16	43	.34	.35	2.4	2,600	360	280
46 (G 1)	5	375	15	16	45	.45	.43	3.0	(3)	(3)	(3)
46 (G 2)	5	430	18	19	45	.45	.46	4.2	(3)	(3)	(3)
18a (G 25)	5	500	21	21	57	.48	.43	4.3	(3)	(3)	(3)
18a (G 32)	4	585	24	24	68	.55	.54	4.3	(3)	(3)	(3)
19a (G 28)	5	585	24	24	68	.55	.54	4.3	(3)	(3)	(3)
5b (G 10)	5	615	25	25	73	.43	.53	5.4	(3)	(3)	(3)
Total or average	40	455	19	19	53	.40	.42	3.6	2,000	310	250
Series 2:											
9c	4	715	32	34	70	.80	.75	8.3	4,300	440	550
9d	5	725	33	35	69	.88	.77	6.1	5,500	580	550
10c	4	690	29	33	69	.78	.71	4.5	3,600	430	450
20b (G 19)	3	515	23	24	52	.55	.53	3.6	3,700	360	350
32b (G 37)	3	515	22	22	58	.54	.52	6.9	5,300	530	390
43c	4	770	34	37	75	.91	.82	5.3	4,500	510	550
57	5	710	30	33	73	.75	.71	6.2	3,000	430	500
58	5	625	27	30	62	.71	.65	3.7	2,700	430	440

TABLE 9.—Average nutritive value per day of food consumed at school by individual children in different age groups—Continued

Age, sex, and identification No.	Days observed	Energy	Protein	Fat	Carbo-hydrate	Calcium	Phos-phorus	Iron	Vitamin A	Vitamin C	Vitamin G
36 to 47 months, boys—Continued.											
Series 2—Continued.											
46.....	5	715	33	33	71	0.83	0.76	4.9	3,500	480	A. C. S. units
47.....	4	600	31	31	63	.77	.71	6.6	3,700	450	560
48.....	5	670	31	31	66	.77	.71	4.6	3,400	470	510
49.....	5	590	29	29	63	.48	.65	5.2	3,200	420	400
20a (G 14).....	4	555	29	23	58	.79	.67	3.6	(^c)	(^c)	(^c)
26 (G 17).....	4	490	22	22	51	.52	.51	3.9	(^c)	(^c)	(^c)
70 (G 17).....	5	600	25	25	69	.62	.59	4.3	(^c)	(^c)	(^c)
Total or average.....	66	635	28	29	65	.71	.66	5.2	3,300	460	480
Total or average (series 1 and 2 combined).....	106	555	25	25	60	.60	.59	4.5	3,200	410	410
48 to 59 months, girls:											
Series 1.....											
124.....	5	415	16	17	49	.30	.33	2.9	2,800	310	250
21 (G 26).....	5	585	22	23	68	.50	.47	4.7	(^c)	(^c)	(^c)
126 (G 30).....	5	540	23	23	60	.48	.51	4.3	(^c)	(^c)	(^c)
22a (G 30).....	5	550	24	21	60	.50	.52	4.5	(^c)	(^c)	(^c)
Total or average.....	20	525	21	22	59	.45	.46	4.1	2,800	310	250
Series 2.....											
16c.....	4	750	34	34	77	.86	.78	4.8	4,400	430	600
54b.....	4	655	31	33	77	.82	.72	4.1	3,600	420	530
49.....	5	745	33	34	77	.85	.79	5.1	3,200	520	500
61.....	5	730	32	33	72	.78	.72	6.1	3,800	440	520
42.....	4	700	31	31	65	.53	.73	4.2	4,000	430	530
63.....	5	705	32	33	70	.74	.74	5.1	4,300	480	530
63.....	5	705	32	33	70	.77	.77	4.6	4,000	530	490
23a (G 32).....	5	690	32	33	66	.65	.62	4.3	(^c)	(^c)	(^c)
27.....	5	695	31	31	66	.91	.82	5.1	(^c)	(^c)	(^c)
22b (G 30).....	5	735	30	33	71	.56	.84	4.5	(^c)	(^c)	(^c)
13c (G 41).....	4	755	33	35	84	.70	.63	4.5	(^c)	(^c)	(^c)
23b (G 33).....	5	825	38	39	90	1.11	1.01	5.2	(^c)	(^c)	(^c)
21 (G 42).....	5	825	40	34	94	1.07	.94	4.1	(^c)	(^c)	(^c)
25 (G 43).....	4	710	35	32	70	1.67	.94	4.1	(^c)	(^c)	(^c)
Total or average.....	60	705	33	32	72	.85	.78	4.8	4,200	470	540
Total or average (series 1 and 2 combined).....	80	665	30	30	69	.74	.69	4.7	3,800	430	470

48 to 59 months, boys:

Series 1:										
26 (G 26)	5	595	22	26	68	.48	.49	5.0	4,200	450
19b (G 31)	5	585	24	24	68	.51	.53	4.7	3,900	560
27 (G 31)	5	570	23	24	66	.51	.52	4.7	5,000	570
Total or average	15	585	23	25	67	.50	.51	4.8	4,300	450
Series 2:										
5a	5	745	34	34	76	.81	.76	5.1	3,900	530
8b	5	680	32	36	66	.80	.75	7.4	4,200	620
41b	5	755	32	36	76	.74	.74	4.9	3,800	430
64	5	770	35	35	79	.93	.84	5.6	4,400	490
65a	3	750	34	33	79	.90	.82	5.7	5,800	550
66a	3	720	32	35	68	.87	.85	4.6	3,400	670
67	5	685	31	31	70	.76	.69	4.8	4,300	540
68	5	630	29	31	59	.71	.68	4.2	4,000	470
69a	5	770	34	36	77	.78	.75	5.4	4,100	530
70	5	725	36	33	74	.78	.74	4.7	4,000	480
71	4	810	36	38	81	.79	.78	5.6	4,600	600
77	5	690	32	32	67	.77	.74	4.6	4,000	560
18b (G 33)	5	750	30	26	99	.71	.69	5.7	(3)	(3)
28a (G 33)	4	730	33	26	91	.77	.77	0.0	(3)	(3)
29a (G 34)	5	680	29	30	73	.72	.68	4.5	(3)	(3)
30a (G 37)	5	680	29	30	62	.51	.50	4.1	(3)	(3)
31a (G 37)	4	515	22	20	62	.74	.69	4.7	(3)	(3)
32a (G 40)	5	595	28	24	67	.90	.97	5.7	(3)	(3)
28b (G 40)	5	800	38	32	93	1.03	.93	4.4	(3)	(3)
32a (G 42)	4	760	37	31	83	.72	.67	4.2	(3)	(3)
30a (G 44)	5	620	29	28	63	.72	.67	4.2	(3)	(3)
29b (G 44)	5	640	30	29	65	.71	.65	4.2	(3)	(3)
Total or average	97	705	32	31	75	.79	.74	5.2	4,200	530
Total or average (series 1 and 2 combined)										
60 to 71 months, boys:	112	690	31	30	73	.75	.71	5.1	4,200	490
Series 2:										
9c	5	730	31	34	75	.72	.71	4.6	3,900	490
30c	5	700	31	34	68	.84	.74	5.0	3,900	420
55b	5	800	35	37	83	.84	.79	5.3	3,100	550
65b	5	730	29	34	77	.72	.71	5.3	2,700	530
66b	5	780	32	36	82	.77	.75	6.9	4,200	560
66c	5	745	31	35	77	.75	.74	5.0	3,400	470
69b	5	735	33	32	79	.80	.77	7.2	3,800	520
72	5	650	31	31	63	.76	.70	4.1	3,800	440
73	5	675	31	30	70	.73	.72	5.2	4,800	550
74	5	670	29	30	71	.65	.65	4.6	4,300	500
75	5	670	30	30	69	.74	.70	6.2	3,500	490
Total or average	55	715	31	33	74	.76	.72	5.4	3,800	480

1 Numbers in parentheses refer to the group study number for those children who also participated in a group study.

2 For description of units see footnote 2, table 6

3 No values obtained.

TABLE 10.—Average nutritive value per child per day of food consumed at school by children in different age groups

Age and group study No.	Week beginning	Meals	Energy ¹	Protein	Fat	Carbo- hydrate	Cal- cium	Phos- phorus	Iron	Vitamin A ²	Vitamin B ²	Vitamin C ²	Vitamin G ²
		Number	Calories	Grams	Grams	Grams	Grams	Grams	Milli- grams	Internat- ional Units ³	Internat- ional Units ³	Internat- ional Units ³	A. C. S. units ³
30 to 41 months:													
Series 1:													
G1	Oct. 12, 1931	90	560	21	23	66	0.50	0.50	3.9				
G2	Nov. 16, 1931	84	655	28	30	69	.65	.69	4.1				
G3	Jan. 11, 1932	75	510	21	24	53	.50	.48	3.2				
G4	Jan. 18, 1932	77	525	21	23	59	.50	.49	4.3				
G5	Feb. 15, 1932	87	500	20	22	56	.46	.46	4.1				
G6	Apr. 11, 1932	91	510	21	23	55	.48	.48	3.7				
G7	May 2, 1932	33	605	26	25	69	.53	.57	4.7				
G8	May 16, 1932	32	575	23	25	65	.65	.51	5.0				
G9	June 13, 1932	64	455	21	21	50	.46	.46	3.3				
G10	Sept. 19, 1932	88	495	20	21	61	.41	.45	4.2				
G11	Oct. 3, 1932	83	475	20	21	56	.40	.43	3.8				
G12	Oct. 18, 1932	88	425	18	18	54	.37	.41	3.7				
Total or average		892	520	21	23	59	.48	.49	3.9	2,700	130	330	340
Series 2:													
G13	Nov. 7, 1932	77	600	27	27	67	.67	.64	4.1				
G14	Dec. 5, 1932	65	530	26	24	58	.64	.61	4.0				
G15	Jan. 23, 1933	71	585	27	26	69	.70	.66	4.4				
G16	Feb. 6, 1933	70	515	25	23	58	.63	.59	3.8				
G17	Feb. 13, 1933	62	610	28	25	74	.70	.67	4.5				
G18	Mar. 13, 1933	71	540	28	25	59	.70	.66	4.0				
G19	Apr. 10, 1933	53	610	29	27	69	.77	.70	4.4				
G20	Apr. 24, 1933	68	610	30	27	70	.76	.71	4.6				
G21	May 8, 1933	51	625	28	28	71	.71	.71	4.4				
G22	May 22, 1933	73	640	29	28	72	.73	.68	4.4				
G23	Dec. 10, 1934	38	660	29	30	69	.72	.67	4.5				
G51	Dec. 10, 1934	50	545	25	24	61	.58	.59	4.2				
G52	Mar. 9, 1936	50	545	25	24	61	.58	.59	4.2				
Total or average		749	555	27	26	66	.69	.65	4.3	3,200	175	420	450
42 to 53 months:													
Series 1:													
G23	Apr. 27, 1931	88	680	27	29	77	.60	.58	3.7				
G24	May 18, 1931	85	555	23	22	65	.48	.49	4.4				
G25	May 14, 1932	78	500	22	21	55	.45	.47	4.2				
G26	Apr. 25, 1932	100	595	22	21	71	.46	.48	4.6				
G27	May 31, 1932	80	560	22	23	66	.47	.48	4.2				
G28	June 6, 1932	64	625	24	25	79	.51	.55	4.3				

[illegible]

² Vitamin values not calculated for groups; calculated for totals only.

³ For description of units, see footnote 2, table 6.

⁴ Includes 21 meals eaten by younger children.

* Includes 11 meals eaten by younger children.

Includes 7 meals eaten by younger children.

includes : means cater to younger student.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE
WHEN THIS PUBLICATION WAS LAST PRINTED

<i>Secretary of Agriculture</i> -----	HENRY A. WALLACE.
<i>Under Secretary</i> -----	M. L. WILSON.
<i>Assistant Secretary</i> -----	HARRY L. BROWN.
<i>Coordinator of Land Use Planning and</i> <i>Director of Information.</i>	M. S. EISENHOWER.
<i>Director of Extension Work</i> -----	C. W. WARBURTON.
<i>Director of Finance</i> -----	W. A. JUMP.
<i>Director of Personnel</i> -----	ROY F. HENDRICKSON.
<i>Director of Research</i> -----	JAMES T. JARDINE.
<i>Solicitor</i> -----	MASTIN G. WHITE.
<i>Agricultural Adjustment Administration</i> ----	H. R. TOLLEY, <i>Administrator.</i>
<i>Bureau of Agricultural Economics</i> -----	A. G. BLACK, <i>Chief.</i>
<i>Bureau of Agricultural Engineering</i> -----	S. H. MCCRORY, <i>Chief.</i>
<i>Bureau of Animal Industry</i> -----	JOHN R. MOHLER, <i>Chief.</i>
<i>Bureau of Biological Survey</i> -----	IRA N. GABRIELSON, <i>Chief.</i>
<i>Bureau of Chemistry and Soils</i> -----	HENRY G. KNIGHT, <i>Chief.</i>
<i>Commodity Exchange Administration</i> -----	J. W. T. DUVEL, <i>Chief.</i>
<i>Bureau of Dairy Industry</i> -----	O. E. REED, <i>Chief.</i>
<i>Bureau of Entomology and Plant Quarantine</i> ---	LEE A. STRONG, <i>Chief.</i>
<i>Office of Experiment Stations</i> -----	JAMES T. JARDINE, <i>Chief.</i>
<i>Farm Security Administration</i> -----	W. W. ALEXANDER, <i>Administrator.</i>
<i>Food and Drug Administration</i> -----	WALTER G. CAMPBELL, <i>Chief.</i>
<i>Forest Service</i> -----	FERDINAND A. SILCOX, <i>Chief.</i>
<i>Bureau of Home Economics</i> -----	LOUISE STANLEY, <i>Chief.</i>
<i>Library</i> -----	CLARIBEL R. BARNETT, <i>Librarian.</i>
<i>Bureau of Plant Industry</i> -----	E. C. AUCHTER, <i>Chief.</i>
<i>Bureau of Public Roads</i> -----	THOMAS H. MACDONALD, <i>Chief.</i>
<i>Soil Conservation Service</i> -----	H. H. BENNETT, <i>Chief.</i>
<i>Weather Bureau</i> -----	WILLIS R. GREGG, <i>Chief.</i>

This circular is a contribution from

<i>Bureau of Home Economics</i> -----	LOUISE STANLEY, <i>Chief.</i>
<i>Economics Division</i> -----	DAY MONROE, <i>Principal Economist,</i> <i>in Charge.</i>

